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Geoengineering and the Humanitarian Challenge: What Role for the Most Vulnerable?

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Geoengineering Our Climate? is a Working Paper and Opinion Article Series that explores the ethics, politics and governance of geoengineering – the intentional manipulation of the global climate to counteract climatic changes. Relying upon the efforts of over forty contributing authors from academia, policy, and civic environmentalism, our objective for this project is to create a comprehensive yet broadly accessible introduction to the complex societal dimensions associated with the emergence of geoengineering. Our Convening Partner organizations include high-profile institutes from across the global north and south: the Institute for Advanced Sustainability Studies (Germany); the Institute for Science, Innovation and Society, University of Oxford (UK); the Consortium on Science Policy and Outcomes at Arizona State University (US); the Council on Energy, Environment and Water (India), the Research Centre for Sustainable Development of the Chinese Academy of Social Sciences (China), and the Brazilian Research Group on International Relations and Climate Change (Brazil).

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As research practitioners working on climate and disasters in the humanitarian sector, we are at once fascinated and terrified by the prospect of geoengineering. Rapidly becoming technically feasible as a "planetary emergency procedure"[1] - somewhere, somehow, the intentional manipulation of the global climate may become politically feasible as well during our lifetime. Sullivan argues that to the engineer, Murphy's Law ("what can go wrong will go wrong") represents a statistical truism[2]; if deployed - geoengineering can go wrong, and *will* go wrong in some way.

Altering the Earth's climate, whether inadvertently through anthropogenic greenhouse gas emissions or deliberately through geoengineering, is an experiment in which every person on our planet is potentially a test subject.[3] Vulnerable populations will be differentially and disproportionately impacted by deployments. Methods like Solar Radiation Management ("SRM") i.e. deflecting sunlight through the dispersal of sulfur particles in the upper atmosphere, can cool the planet (the desired effect), but – like global climate change - can also trigger changes in rainfall patterns that are nearly impossible to predict.[4] Haywood et al suggest that volcanic eruptions, which SRM would mimic, influenced increased desertification of the Sahel between 1970 and 1990.[5] This is the Sahelian drought in which 250,000 people perished, leaving 10 million refugees in its wake. While they conclude, "Further studies of the detailed regional impacts on the Sahel and other vulnerable areas are required to inform policymakers in developing careful consensual global governance before any practical solar radiation management geoengineering scheme is implemented", new geophysical research suggests a causal correlation between these Sahelian droughts and sulfate aerosols from coal-burning in North America and Europe.[6]

This raises two key questions from the humanitarian perspective:

1. What role, voice or agency will the vulnerable have in geoengineering decisions?
2. Who will pay for humanitarian operations in a geoengineered future?

Regrettably, past experience and Murphy's Law invite two unacceptable predictions:

The most likely answer to the first question is simply, "None". There is currently no governance framework for geoengineering research or deployment, scarce evidence of any real effort to include the really vulnerable in the rarified debate around whether or not to act, and generally deemed too expensive to seek informed consent from all those at risk should the experiment go awry. As argued by Blackstock and Long, geoengineering stakeholders need to consider whether existing frameworks can facilitate an accessible, transparent process, or whether new fora, treaties, and organizations are required.[7]

For the second question, the status quo answer is "Nobody who causes harm through geoengineering will pay for humanitarian operations", regardless of whether they consti-

[1] Kintisch 2010
[2] Sullivan 1995
[3] Suarez et al. 2010
[4] It is perhaps equally challenging to predict local impacts of climate change. Moreover, it is unknown how intentional climate modification would interact with short-lived climate forcers like black carbon from fossil fuel burning.
[5] Haywood et al. 2013
[6] Hwang et al. 2013
[7] Blackstock and Long 2010

tute 'normal' disaster management or humanitarian aid directly in response to geoengineering impacts. Geoengineering deployments that shift the burden of impacts constitute humanitarian externalities. The history of the United Nations Framework Convention on Climate Change, history suggests that institutional forces allow existing greenhouse gas externalities to prevail. This inertia can only be expected to become more entrenched when the climate system shows more signs of man-made instability.

Notwithstanding, we need to prove these dastardly predictions wrong. To ensure that the vulnerable have increased input into decision-making processes, and that anticipating and paying for the negative impacts of geoengineering is 'internalized' by deployers. it is crucial to begin identifying principles, pathways, and structures that might address concerns from the humanitarian community and the differentially vulnerable populations they serve.

Proponents ask a valid question: Will the results of deploying geoengineering be worse than the alternative – inaction in the face of accelerating global climate change? The answer is both "We don't know" and "It depends". Humanitarian work is precisely about addressing things gone wrong. Victims of disasters are often the victims of individual and collective failures to reduce disaster risks, and the more vulnerable are differentially impacted. A drought that kills thousands in Niger may only lead to reduced profits if in Nebraska. The IPCC's Special Report on Extreme Events (2012) asserts that a new balance needs to be struck between measures to reduce risk, transfer risk (e.g. through insurance) and effectively prepare for and manage disaster impact in a changing climate.[8] This balance will require strengthened emphasis on *anticipation* and *risk reduction*. Given the prospects of geoengineering, it is our duty to anticipate what can go wrong for those who lack the means to cope with surprises, and to ensure that the most vulnerable have the capacity to effectively manage anticipated risks. We posit that differential impacts on the more vulnerable are highly probable in a geoengineered climate, so if decisions are made to deploy SRM for the intended benefit of one portion of the global population while causing others to suffer, this intentional shifting of the burden of coping represents a humanitarian externality.

We propose a guiding framework to examine the humanitarian challenge based on the concept of negative externality, i.e. when Party A (i.e. a developed nation[9]) seeking benefit B (i.e. climate control) implements an activity or transaction T (i.e. solar radiation management) with consequences which cause losses or costs C (i.e. crop failure) to an otherwise uninvolved Party Z (i.e. subsistence farmers in a particular developing nation or nations), who did not choose to incur the negative impact.

The prospect of insufficient emissions reduction is irrefutable, largely due to the inability of governance and market structures to address such externalities. As Martinez-Alier has argued, the notion of an externality as a 'market failure' can also be understood as a successfully transferred cost.[10] Some benefit,

[8] IPCC 2012
[9] There is also the possibility that a developed nation could seek to deploy geoengineering (probably SRM) as a humanitarian measure on behalf of a vulnerable nation. See Suarez et al. 2010
[10] Martinez-Alier 2002

many others suffer. With global warming already unavoidable, we face the humanitarian imperative of addressing its consequences: even as mitigation and adaptation remain critically important, and interest in geoengineering increases, it is important to remember that we have the collective knowledge and capability to create paradigm-shifting ways to address humanitarian concerns.

We propose framing geoengineering research and policy agendas in ways that explicitly integrate the role of the most vulnerable through *Learning, Preparing,* and *Preventing* as a way to internalize humanitarian externalities:

Learning: Identify Z's likely costs C, and research them at least as much as benefits B are researched by Party A. (In other words, we should for example identify the subsistence farmers' likely costs due to crop failure as a result of SRM and research these costs as much as benefits (such as climate stabilization) are researched by the developed nation where SRM research is taking place. This suggestion is particularly directed to climate scientists.

Preparing: Identify the Party Z (i.e. the subsistence farmer) who would be excluded from decision-making about activity T and seek to include her. Importantly, help Z understand decision processes potentially leading to activity T, so as to confer agency and capacity to influence her own future. If the risk of negative consequences is deemed high, support her in reducing likely costs C (i.e. crop failure). This suggestion is particularly directed to policy-makers and the humanitarian sector.

Preventing: Seek to establish mechanisms that either prevent the successful transfer of cost C (i.e. the cost of crop failure) from any Party A (i.e. the nation deploying SRM) to any Party Z (i.e. subsistence farmers), or internalize the externality (through mechanisms such as environmental assurance bonds— described below).

For *Learning*, we can design active participatory research that foregrounds the interests and involvement of the most vulnerable, to broaden the range and relevance to them of the research questions. This includes research into the more nuanced aspects of atmospheric behavior that play determining roles in the lives and livelihoods of subsistence farmers, shantytown dwellers and others already on the edge of survival. For example, maize cultivation in southern Africa critically depends on the timing of precipitation within the parameters of the crop's phenological cycle. The same applies to the incidence of unusual conditions conducive to crop pests. Thus food security is very sensitive to changes in atmospheric circulation patterns that drive changes in precipitation such as the onset and duration of seasonal rains, frequency and timing of dry spells, or rainfall intensity during critical periods such as germination and ripening. [11] However, most geoengineering impact modeling examines less nuanced aspects, such as mean annual precipitation or temperature changes (see for example Shepherd et al 2009). What such research can offer is to uncloak our colossal ignorance about the likely negative impacts of geoengineering – and help to reduce this knowledge gap.

For *Preparing*, geoengineering stakeholders should support new approaches to participa-

[11] Tadross et al. 2009

tory decision-making and expand the scope of how we create and share knowledge about what is possible – and desirable. Options include experiential games for learning and dialogue that simulate the complexity of climate-related decisions and related consequences, to help engender systems-thinking including information needs, feedbacks, delays, thresholds and trade-offs,[12] [13] as well as participatory video – a way to involve a group in filming their own story, from storyboarding to interviewing and camera operation that enables people to distill and share their own experience and insights.[14]

Of course, experiential games and video in and of themselves may not be enough to support Party Z (i.e. the subsistence farmer) in reducing likely costs C (i.e. crop failure). Nevertheless, participatory decision-making can spark a deeper discussion amongst all levels of society about how best to support Party Z. If people are invested at all levels, we are more likely to find useful answers and perhaps formulate a formal framework. As of now, absolutely nothing is being done to let Party Z know what geoengineering proponents are contemplating. These creative platforms may enable the most vulnerable to form an opinion and perhaps influence formal governance processes. It is the government's responsibility to elicit Party Z's opinion, which brings up the usual challenges associated with bringing in the voices of the marginalized. But, at least, thanks to these participatory mechanisms, Party Z will have an informed opinion – and a motivation to make that opinion count.

For *Preventing*, it is necessary to open and nurture an inclusive process for examining key governance decisions and research areas so that conflicting definitions or designations of vulnerability and geoengineering-related impacts, loss and damages may be reconciled. Additionally, we should support research and policy efforts to innovate through corrective mechanisms and financial instruments designed to internalize the negative externalities incurred by the most vulnerable. Possibilities range from international governance frameworks to further research into market-based tools. The development of environmental assurance bonds, which could require geoengineers or their funders to post a guarantee price equivalent to the worst-case threats posited by a particular deployment scheme, looks promising.[15]

At present, from the humanitarian perspective it is not possible to reliably compare the risks of geoengineering to the risks of unfettered climate change. It is important to note that we are not experts in the many disciplines needed to inform an agenda and policy on their relative impacts and externalities. The growing geoengineering community is actively exploring options. We submit that there is a moral imperative to facilitate involving the most vulnerable in decision-making about geoengineering. The concept of internalizing potential negative externalities offers an operational framework for the applying the principles and pathways suggested in this article, to help inform a more inclusive and nuanced conversation about what can go wrong - and what must go right.

[12] Participatory games have successfully been used to engage illiterate Ethiopian farmers in the design of complex index insurance instruments and other climate risk financing approaches – they surely can help engage humanitarian workers and vulnerable people in the geoengineering debate.

[13] Mendler de Suarez et al. 2012

[14] Suarez et al. 2011

[15] Banerjee 2011

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